



SECTION 301

PLANT MIX BITUMINOUS BASE COURSE

301.1 Description. This work shall consist of aggregate, filler if needed, and asphalt binder mixed in a stationary bituminous mixing plant in such proportions that the resulting mixture meets the grading requirements of the job-mix formula. The mixture shall be placed, spread and compacted in conformity with the lines, grades, thicknesses and typical cross sections shown on the plans or established by the engineer.

301.2 Material. All material shall conform to Division 1000, Materials Details, and specifically as follows:

Item	Section
Coarse Aggregate	1002.1.1 to 1002.1.2 incl.
Fine Aggregate	1002.2
Mineral Filler	1002.3
Hydrated Lime	1002.4
Asphalt Binder, Performance Graded (PG)	1015

The grade of asphalt binder will be specified in the contract.

301.2.1 The gradation of coarse aggregate shall be such that the total aggregate meets the gradation requirements specified in [Sec 301.3](#) prior to being fed into the cold aggregate feeders.

301.2.2 When screenings are used, they shall be considered coarse aggregate consisting of tough, durable particles of approved quality, and shall be free from dirt or other objectionable material. The fraction passing a No. 40 (425 µm) sieve shall be non-plastic.

301.3 Composition of Mixtures. The bituminous base shall be composed of a mixture of crushed limestone or dolomite, except as hereinafter permitted, filler if needed, and asphalt binder. The total aggregate prior to mixing with asphalt binder shall meet the following gradation requirements:

Sieve Size	Percent Passing by Weight (Mass)
1 inch (25.0 mm)	100
1/2 inch (12.5 mm)	60-90
No. 4 (4.75 mm)	35-65
No. 8 (2.36 mm)	25-50
No. 30 (600 µm)	10-35
No. 200 (75 µm)	5-12

At the option of the contractor, fine aggregate may be incorporated into the mixture. The total quantity of such fine aggregate shall not exceed 30 percent by weight (mass) of the combined aggregate and shall be added at the plant by means of a separate cold aggregate feeder.

301.3.1 The composition of the mixture shall be as directed by the engineer and shall conform to the following limits by weight (mass):

Item	Percent
Total Mineral Aggregate	94-97
Asphalt Binder	3-6

301.3.2 At least 30 days prior to preparing any of the mixture on the project, the contractor shall obtain, in the presence of the engineer, representative samples of asphalt binder and mineral aggregates for tests. The samples of the material shall be of the size specified by the engineer and shall be submitted to the Central Laboratory for testing. The contractor shall also submit for the engineer's approval, a job-mix formula for the mixture to be supplied for the project. No mixture will be accepted for use until the job-mix formula for the project is approved by the engineer. The job-mix formula shall be within the gradation range specified for bituminous base and shall include the type and sources of all material, the gradations of the aggregates and the relative quantity of each ingredient, if more than one, and shall state a definite percentage for each fraction of aggregate. No job-mix formula will be approved which does not permit within the limits specified in [Sec 301.3](#) and [301.3.1](#) the full tolerances specified in [Sec 301.3.4](#) for asphalt binder and not less than 1/2 the tolerances specified in [Sec 301.3.4](#) for material passing the No. 8 (2.36 mm) sieve and the material passing the No. 200 (75 µm) sieve. The job-mix formula approved for the mixture shall be in effect until modified in writing by the engineer. When unsatisfactory results or other conditions make it necessary, or should a source of material be changed, a new job-mix formula may be required.

301.3.3 The engineer will make such changes in the proportions of asphalt binder and aggregates as considered necessary. The proposed mixture will be compacted and tested in the laboratory in accordance with AASHTO T 167 or AASHTO T 245, at the option of the engineer and modified as follows. The test method used shall be modified by aging the mixture for two hours, at the specified compaction temperature range of the asphalt binder, just prior to compaction of the specimens. The mixture of mineral aggregate and asphalt binder shall result in a bituminous mixture which will be durable and retain satisfactory cohesion and stability in the presence of moisture.

301.3.3.1 Moisture susceptibility may be tested in accordance with AASHTO T 283 or AASHTO T 165, at the option of the engineer. A minimum retained strength of 70 percent shall be obtained when tested for moisture susceptibility. If requested by the contractor, hydrated lime may be added to increase retained strength to a passing level.

301.3.4 Gradation Control. In producing mixtures for the project, the plant shall be so operated that no intentional deviations from the job-mix formula are made. Mixtures as produced shall be subject to the following tolerances and controls:

(a) The total aggregate gradation shall be within the master range specified in [Sec 301.3](#).

(b) The maximum variations from the approved job-mix formula shall be within the following tolerances:

Passing No. 8 (2.36 mm) sieve	±5.0 percentage points
Passing No. 200 (75 µm) sieve	±2.0 percentage points

(c) The quantity of asphalt binder introduced into the mixer shall be that quantity specified in the job-mix formula. No change may be made in the quantity of asphalt binder specified in the job-mix formula without written approval of the engineer. The quantity of

asphalt binder determined by calculation or tests on the final mixture shall not vary more than ± 0.5 percentage point from the job-mix formula.

301.3.5 The gradations of the total aggregate will be determined from samples taken from the hot bins on batch-type plants or continuous mixing plants or from the composite cold feed belt on drum mix plants. Batch-type or continuous mixing plants shall have a screening unit which separates the usable heated aggregate into at least two sizes. One of the aggregate bin sizes produced by the screening unit shall contain not more than 10 percent by weight (mass) retained on the No. 4 (4.75 mm) sieve.

301.3.6 At the option of the contractor and at no revision in unit price of either the asphalt binder or the mineral aggregate, the contractor may use an approved Type IB or Type IC asphaltic concrete mixture, produced in accordance with the requirements of [Sec 403](#), in lieu of the plant mix bituminous base course mixture. When this substitution is made, the layer thickness, roller and density requirements of [Sec 301](#) will apply.

301.3.7 Commercial Mixture. If specified in the contract that an approved commercial mixture may be used, the contractor shall, at least seven days prior to the desired time of use, furnish a statement setting out the source and characteristics of the mixture proposed to be furnished. The statement shall include: (1) the types and sources of aggregates, percentage range of each and range of combined gradation; (2) the percent and grade of asphalt binder; and (3) the mixing time and range of mixture temperature. The plant shall be designed and operated to produce a uniform, thoroughly mixed material free from segregation. It will not be necessary for the plant to meet the requirements of [Sec 301.6](#). A field laboratory will not be required. If the proposed mixture and plant are approved by the engineer, the component material and the mixture delivered will be accepted or rejected by visual inspection. The supplier shall furnish with the first truck load of each day's production, a certification in triplicate that the material and mixture delivered are in conformance with the approved mixture. Upon completion of the work, a plant certification in triplicate shall be furnished by the supplier for the total quantity delivered. The mixture shall be transported and placed in accordance with the requirements specified in [Sec 301.8](#) through [301.12](#) and shall be compacted as specified in [Sec 301.11](#).

301.3.7.1 Without specific contract designation, an approved commercial mixture meeting the requirements of [Sec 301.3.7](#) may be used in lieu of plant mix bituminous base course mixtures for work that is considered temporary construction and is to be maintained at the contractor's expense. Temporary construction is work that is to be removed prior to completion of the contract.

301.4 Field Laboratory. The contractor shall provide a Type 3 Field Laboratory meeting the requirements of [Sec 601](#). No direct payment will be made for providing the laboratory.

Construction Requirements

301.5 Weather Limitations. Bituminous mixtures shall not be placed (1) when either the air temperature or the temperature of the surface on which the mixture is to be placed is below 40 F (5 C), (2) on any wet surface or frozen pavement, or (3) when weather conditions prevent the proper handling or finishing of the mixture. Temperatures shall be obtained in accordance with MoDOT Test Method T20.

301.6 Bituminous Mixing Plants. Bituminous mixing plants and preparation of material and mixtures shall conform to the requirements of [Sec 404](#).

301.7 Subgrade Preparation. The subgrade upon which the bituminous mixture is to be placed shall be prepared in accordance with [Sec 209](#) and tacked or primed, as specified in the contract, in accordance with [Secs 407](#) and [408](#), as applicable.

301.7.1 For widening work, the bottom of the trench shall be compacted until it is firm by use of a trench roller having a weight (mass) of not less than 300 pounds per inch (5.5 kg/mm) of width of rear roller, or by mechanical tampers or other methods approved by the engineer. Suitable excavated material may be used in shouldering operations. All surplus excavated material shall be disposed of by the contractor in areas to be secured by the contractor beyond the right of way limits. If surplus excavated material is disposed of outside the right of way, an acceptable written agreement with the property owner on whose property the material is placed shall be submitted by the contractor.

301.7.1.1 On the outside of curves, the design depth of trench at the beginning of the superelevation transition shall be varied gradually to the minimum depth at the end of the superelevation transition. Slight transitioning of the width of the base widening will be necessary to permit the indicated angle of repose or shear angle outside of the ultimate edge of surface. The bottom of the trench shall in no case be less than 3 inches (75 mm) below the surface of the existing pavement.

301.8 Hauling Equipment. Trucks used for hauling bituminous mixtures shall comply with the requirements of [Sec 404](#).

301.9 Spreading. The base course, primed surface or preceding course or layer shall be cleaned of all dirt, packed soil or any other foreign matter prior to spreading the bituminous mixture. When delivered to the roadbed, the mixture shall be at a temperature which will permit proper placement and compaction. The mixture shall be spread with an approved spreading and finishing machine in the number of layers and in the quantity required to obtain the compacted thickness and cross section shown on the plans. When placing multiple layers with varying thicknesses, the thicker layer shall be placed first. The compacted thickness of a single layer shall be between 3 and 4 inches (75 and 100 mm), except as follows:

(a) For spot-leveling and leveling course work, the layer thickness may be less.

(b) For base widening, the material may be placed in two layers, provided no individual layer has a compacted thickness greater than 7 inches (175 mm).

301.9.1 The mixture shall be spread without tearing the surface and struck off so that the surface is smooth and true to cross section, free from all irregularities, and of uniform density throughout. Care shall be used in handling the mixture to avoid segregation. Areas of segregated mixture shall be removed and replaced with suitable mixture. The outside edges of the base shall be constructed to an angle of approximately 45 degrees with the surface of the roadbed. The outside edge alignment shall be uniform and any irregularities shall be corrected by adding or removing mixture before compacting.

301.9.2 Leveling Course. If required by the contract, a leveling course consisting of a layer of variable thickness shall be spread to the desired grade and cross section to eliminate irregularities in the existing surface. Spot-leveling operations over small areas, with feather-edging at high points and ends of spot areas, may be required prior to placing the leveling course. Rigid control of the placement thickness of the leveling course will be required. The use of an approved finishing machine will be required on the spot-leveling and the leveling course, except that the spreading of the spot-leveling with a blade grader will be permitted if results indicate the mixture is practically free from segregation.

301.9.3 Base Widening. The specified total thickness of base widening shall be completed to the adjacent traveled way elevation as shown on the plans. Additional thickness of base widening may be placed as required prior to coldmilling, at the contractor's expense, and shall subsequently be coldmilled to the same elevation as the traveled way, if conducive to expedite operations and approved by the engineer. On base widening work, a succeeding layer of bituminous mixture may be placed the same day as the previous layer, if it can be shown that the desired results are being obtained. On small areas, and on areas which are inaccessible to mechanical spreading and finishing equipment, the mixture may be spread and finished by hand methods if permitted by the engineer.

301.9.3.1 At least one lane of the existing pavement and the adjacent shoulder shall be kept open to traffic at all times during construction, except for short intervals when the movement of the contractor's equipment will seriously hinder the flow of traffic. Intervals during which the contractor will be allowed to halt traffic shall be as designated by the engineer. The contractor shall not open more trench ahead of the first layer of the base widening than is necessary for placing that layer in 1/2 day's operations. The first layer of the base widening shall not be placed for a greater distance ahead of the second layer than is necessary for placing the second layer in 1/2 day's operations. The second layer shall not be placed for a greater distance ahead of the final layer than is necessary for placing the final layer in one day's operation. Any changes in these lengths shall be made only with the written permission of the engineer.

301.9.4 For roadways constructed under traffic, no pavement edge differential shall be left in place for more than seven calendar days, unless approved by the engineer.

301.10 Joints. Longitudinal and transverse joints shall be carefully made and well bonded. The minimum density of all traveled way pavement within 6 inches (150 mm) of a longitudinal joint, including the pavement on the traveled way side of the shoulder joint, shall not be less than 2.0 percent below the specified density. Once an established procedure has been demonstrated to provide the required density for longitudinal joints, at the engineer's discretion, the procedure may be used in lieu of density tests provided no changes in the material, typical location or temperatures are made. Pay adjustments due to longitudinal joint density shall apply to the full width of the traveled way pavement and shall be in addition to any other pay adjustments. Transverse joints shall be formed by cutting back on the previous run so as to expose the full depth of the layer. When a transverse vertical edge is to be left and opened to traffic, a temporary depth transition shall be built as approved by the engineer. The longitudinal joints in one layer shall offset those in the layer immediately below by approximately 6 inches (150 mm).

301.11 Compaction. Rolling shall begin as soon after spreading the mixture as it will bear the weight (mass) of the roller without undue displacement. All rollers shall be in satisfactory condition capable of reversing without backlash, and steel wheel rollers shall be equipped with scrapers. Rollers shall have a system for moistening each roll or wheel. A trench roller shall be used on depressed areas inaccessible to regular width equipment. The compacted mixture shall have a density of not less than 95 percent of that obtained by the laboratory compaction of a specimen made in the proportions of the approved mixture. Density will be determined by the direct transmission nuclear method in accordance with MoDOT Test Method T41 or by a specific gravity method.

301.11.1 In lieu of roller and density requirements, mixtures used for shoulders and temporary by-passes to be maintained at the expense of the contractor and areas where a commercial mixture is used shall be thoroughly compacted by at least three complete coverages over the entire area with either a pneumatic tire roller weighing (having a mass of) not less than 10 tons (9 Mg), a tandem-type steel wheel roller weighing (having a mass of) not less than 10 tons (9 Mg) or an approved vibratory roller. Rolling shall be performed at proper

time intervals on each layer and shall be continued until there is no visible evidence of further consolidation.

301.12 Surface Tolerance. The finished layers shall be substantially free from waves or irregularities and shall be true to the established crown and grade. At transverse construction joints the surface of all layers shall not vary from a 10-foot (3 m) straightedge, applied parallel to the center line, by more than 1/4 inch (6 mm), except that the entire surface of the final layer of plant mix bituminous base mixture shall not vary from the 10-foot (3 m) straightedge by more than 1/8 inch (3 mm) if this layer is used as the final riding surface course. Areas exceeding this tolerance shall be re-rolled, replaced or otherwise corrected in a manner satisfactory to the engineer.

301.12.1 The surface of the mixture after compacting shall be smooth and true to the established crown and grade. Any mixture showing an excess of bituminous material or that becomes loose and broken, mixed with dirt, or is in any way defective shall be removed and replaced with satisfactory mixture, which shall be immediately compacted to conform with the surrounding area.

301.13 During construction, the engineer will make as many tests as are necessary to ensure that the course is being constructed of proper thickness, composition and density. The contractor shall cut samples of the compacted mixture from any layer at locations designated by the engineer and shall deliver them to the field laboratory in good condition. Samples may be obtained by either sawing with a power saw or by drilling 4-inch (100 mm) diameter cores. Each sawed sample shall consist of a single piece of the pavement of the size designated by the engineer but not larger than 12 inches (300 mm) square. Each cored sample shall consist of four cores. If the thickness of the layer is greater than 4 inches (100 mm), two cores will be required in lieu of four. All samples shall be taken the full depth of the layer to be tested and shall consist of an undisturbed portion of the compacted mixture. The surface from which samples have been taken shall be restored by the contractor not later than the next day of plant operation.

301.14 Method of Measurement. The weight (mass) of the mixture will be determined from the batch weights (masses) if a batch-type plant is used, and will be determined by weighing (by determining the mass of) each truck load on scales conforming to the requirements of [Sec 310.4.3](#) if other types of plants are used.

301.14.1 Measurement of asphalt binder, to the nearest 0.1 ton (0.1 Mg) for the total tonnage (mass) used in the accepted work, will be determined by the use of the formula of the approved mixture applied to the weight (mass) of accepted mixture of mineral aggregate and asphalt binder.

301.14.2 Measurement of the weight (mass) of mineral aggregate, to the nearest ton (megagram), will be determined by subtracting the weight (mass) of the asphalt binder from the weight (mass) of the mixed mineral aggregate and asphalt binder.

301.15 Basis of Payment. The accepted quantities of plant mix bituminous base course will be paid for at the unit price for each of the pay items included in the contract. Payment for obtaining and delivering samples of compacted mixture from the base and replacement of the surface will be made per sample at the fixed unit price specified in [Sec 109.14](#).

301.15.1 No direct payment will be made for excavating the trench for base widening, or for hauling and disposing of excess excavation material.